L. Caesar 2528
Compliments of
A. V. Mitchener

Price of this Bulletin for Distribution Outside Manitoba: Five Cents per Copy

Manitoba Farmers' Library

Published by the Manitoba Department of Agriculture and Immigration

WINNIPEG, CANADA, MAY, 1924

The Manitoba Farmers' Library is a series of bulletins that are devoted to the extension of information on Agricultural and Home Economics subjects, and that are distributed free among the people of Manitoba who make application for them. If any particular bulletin is wanted, ask for it as Extension Bulletin No.....
All requests should be addressed to:
The Publications Branch, Department of Agriculture, Winnipeg.

EXTENSION BULLETIN NO. 75

CONTROL OF GRASSHOPPERS

By
A. V. MITCHENER
ASSISTANT PROFESSOR OF ENTOMOLOGY,
Manitoba Agricultural College,
WINNIPEG, MAN.

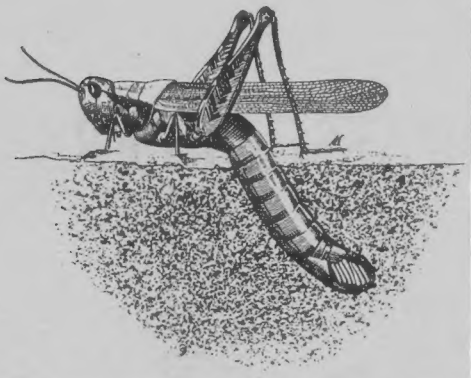
Published by authority of Hon. John Bracken, Minister of Agriculture and Immigration

The Control of Grasshoppers

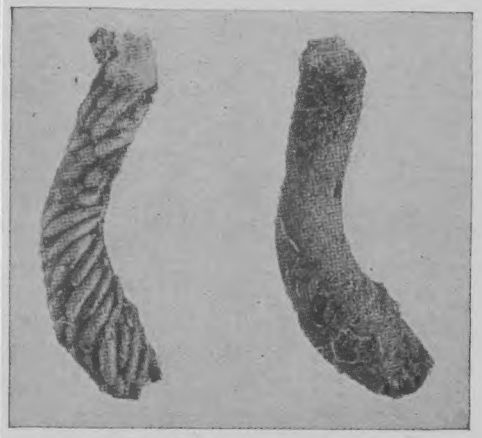
(1) EARLY SPRING CONTROL

Bury the Eggs

Examine short grassed areas along roadsides, fences, lanes, headlands, etc., for egg beds, especially if grasshoppers were plentiful on the farm the previous season. If egg pods are found, the infested area should be plowed before any of the eggs hatch. Small areas of this character hold millions of eggs which will hatch later and infest whole fields. Plow these areas six inches deep, turning the furrow upside down. Use a skimmer on the plow, so that all the sod will be buried six inches deep. If possible, pack this land so that the young hoppers cannot get up through any cracks to the surface. An examination should also be made of stubble lands which were not fall plowed, to see if egg pods are present. If only a few egg pods are found per square



Grasshopper laying eggs in the ground. (After Gibson and Criddle.)



Grasshopper egg pods (enlarged). The cluster at the left has the earth removed to show the arrangement of the eggs in the pod. (After Cooley, et al).

yard, there are enough potential grasshoppers there to infest the whole field. Such fields should be plowed six inches deep and the furrow turned upside down, not on edge. Use a skimmer on the plow so that all eggs shall be buried.

(2) LATE SPRING AND SUMMER CONTROL

(a) Burn Straw

If short grassed areas, such as mentioned above, have not been plowed, and if the young grasshoppers have already emerged in great numbers, good control work may be accomplished by covering such areas with straw and burning it. These grasshoppers return to their hatching grounds to roost each night for a short time after they hatch. The straw should be burned some cool evening after they have taken shelter in it. Sometimes patches of dry weeds covering ground where young hoppers have emerged may be burned, with a great destruction of young hoppers.

(b) Use Poisoned Baits

Once the grasshoppers have hatched, certainly the best way to kill them is by means of poisoned baits. Since our injurious grasshoppers can fly, any local outbreak is not only the affair of the farmers directly concerned but also of the whole community. The infested area of one year may shift to another locality the next year. It may pay the farmers exceedingly well in an immune area to assist in controlling an outbreak

as the infestation may shift their way next year if not controlled. Townsmen are interested in the crops around the town, and in most cases are willing to help poison grasshoppers.

New Poisoned Bait Formula

Finely cut green fall rye or wheat plants	100 lbs.
White arsenic or paris green	5 lbs.
Common Salt	5 lbs.
Water	Sufficient to moisten

During the summer of 1922 comparative tests were made of a number of baits at Manitoba Agricultural College. Baits containing finely cut green wheat plants as a carrier for the poison proved more attractive to grasshoppers than those containing bran and sawdust. Field experiments were undertaken during the summer of 1923 with excellent killing results. The original idea underlying the use of green fall rye or wheat plants was to get a carrier for poisons which does not cost the farmer actual cash, as does bran. The rye or wheat plants are produced on the farm, and, although it takes time to run the green plants through a cutting box, there is no actual money outlay connected with that part of the bait. Fall rye comes on early in the spring, and by the time baits are needed to control grasshoppers, rye plants are a good size. From the fall rye field cut the needed amount of green plants, and run them through a cutting box, cutting the plants up as fine as possible. The finer the pieces are, the better. Later in the season, when the rye is too far advanced, wheat plants may be prepared in the same manner. This finely cut material may then be used to mix with the poison, etc., exactly as the bran was used during the grasshopper outbreak. The plants, being green and moist, retain their freshness and attractiveness longer than bran, which is known to dry out relatively fast after being scattered on the ground.

Manitoba Poisoned Bait

Bran	50 lbs.
Sawdust	Bulk equal to bran
White arsenic or paris green	5 lbs.
Salt	5 lbs.
Water	Sufficient to moisten

Note—100 lbs. of bran may be used in the above formula if sawdust cannot be obtained.

The above is the regular bait which has been used in Manitoba with such good results.

Central Station for Mixing Poisoned Baits

Where the outbreak of grasshoppers is at all extensive in a community, and where a number of farmers are using the bait, it is important that the mixing be done at some central mixing station. This system saves a great deal of time to the farmer and also enables him to secure uniformly well mixed baits, which are absolutely essential for successful grasshopper control. A mixing station should be located in the centre of an infested area if possible, so that it may be equally accessible to all who need the ready mixed baits.

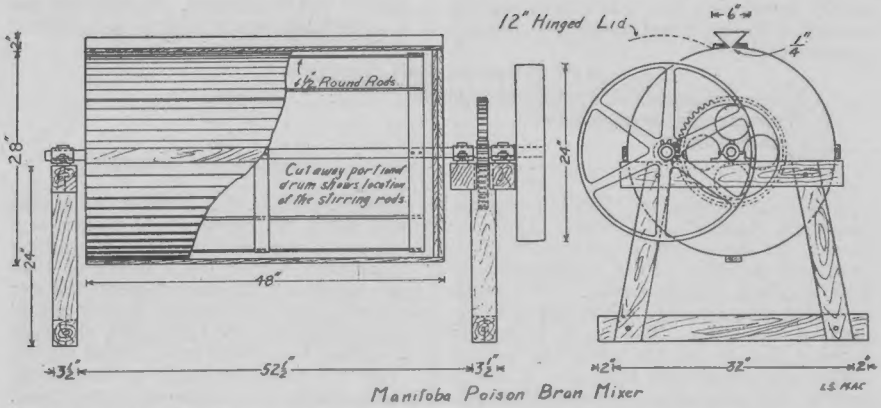
The Mixing Machine

During the recent outbreak a home-made mixing machine was devised in Manitoba which has a capacity of several tons of poisoned bait daily. One important feature of this machine is that it can be made in any town from parts of worn-out machinery and at very small cost.

The following materials are needed :—

(1) Several pieces of timber 4 in. x 4 in.
(2) The fan shaft from any old threshing machine.
(3) Old mower gears.
(4) A drive wheel.
(5) New Sheets of galvanized iron.
(6) Miscellaneous lumber, strips of wood, iron rods, etc.

The frame of the machine may be made either of wood or iron. The ends of the drum are made of two-ply of inch boards while the remainder of the drum is made of new sheets of galvanized iron. The arms attached to the fan shaft of the old threshing machine are used to hold stirring rods which run from end to end. Two half inch rods are run through each arm along the length of the fan shaft. In all, there are eight of these rods extending the length of the inside of the drum. On the top of the drum a hinged lid extends along its whole length through which the dry ingredients are dumped



The Manitoba Mixing Machine. At the left a longitudinal view and at the right a view of the end.

into the machine. Just above this there is arranged a trough through which the water is poured after the dry materials have been thoroughly mixed. Men who do the mixing find this trough very useful since when the lid is opened upon the dry mixture the fine particles of the poison fly out into the air with injurious effects upon those who are forced to be continually in the room. A drive wheel is selected which will turn the shaft at about 15 revolutions per minute. A gasoline engine supplying two or three horse power is usually satisfactory.

When the machine is in operation, the drum is fastened by a hasp or bar to the framework, yet is so arranged that it may be unfastened when the mixer is stopped. The drum may then be given a half revolution, so that the whole mixture may be dumped on the floor. As soon as the mixture is out, the drum is revolved back into position and fastened securely.

When the machine is running, the mixing rods slowly revolve and stir the mixture within the stationary drum. When the dry materials have been thoroughly stirred, the liquid is added while the machine continues its work, so that no time is lost in this operation. The whole machine should be placed on the edge of an elevated platform, so that when the mixture is dumped it falls out of the way of the workers and the machine.

Mixing in Smaller Amounts

Where only enough bait is required to poison the grasshoppers on one farm, the mixing may be done by means of a shovel. Where the fall rye or wheat plants are used as a carrier for the poison, these should be cut up very fine in a cutting box and spread out on a cement floor or other smooth surface. For each hundred pounds of cut plants sprinkle on 5 lbs. of white arsenic and 5 lbs. of common salt. It is best to put only a part of each of these on at a time before stirring, as it is very necessary to have the poison on every particle of the cut plants. Only those particles with poison actually on their surfaces are of any value. After mixing well, a small quantity of water should be added to make the mixture moist. Water should not drip when a handful is squeezed. Shovel the whole pile over and over again and then put in bags ready to take to the field. Be sure that the floor is cleaned up and that the bags are destroyed after the bait is used. Animals have been killed by carelessness. Mixed baits may be held over in bags for days before being scattered. Some claim that baits so held are better than freshly mixed baits. Bran baits which have soured have done good work. Where bran and sawdust are used as the carrier for the poison, the mixing process is carried out exactly as above.

Where and How to Scatter the Baits

One of the most important considerations in poisoning grasshoppers is the time to scatter the baits. Baits should be scattered on a morning which promises to be the forerunner of a warm, sunny, calm day. Grasshoppers will not feed on a rainy, dull, windy day, and therefore, mixed baits should be held until favorable weather prevails. Government weather forecasts are very useful for indicating expected weather conditions.

Baits should be scattered in the forenoon any time after seven o'clock. Baits should be scattered or broadcasted just as grass seed is broadcasted on the land. A handful of bait should be scattered thinly with the fingers and thumb. Actual killing results

Broadcasting the bait. Note that the rows of grain have been entirely eaten away along the edge of the field. The grasshoppers take from two to three days to die after eating the bait.

are better where the bait is scattered very thinly. Under no circumstances place the bait out in piles or rows along the edge of the field. Such bait will be wasted. The bait should be scattered in strips along the edge of the field where the grasshoppers are actually feeding and again in a strip a little ahead of where they are active. In fields where they are scattered throughout the whole crop the bait should be scattered lightly in strips over the whole field. The tendency is to spread too much on the ground rather than too little. Results of the poisoned bait may be seen in twenty-four hours, but maximum results should not be expected inside of forty-eight hours. Care should be taken not to mistake cast-off skins from the molting young for dead grasshoppers.

(c) *Control on Land to be Summerfallowed*

When farmers are plowing late summerfallows, frequently great numbers of grasshoppers are found on this land. Until these grasshoppers reach maturity and develop wings they feed upon the vegetation at hand. As soon as they grow wings they usually move out into the crops. It is, therefore, important to kill them while they are still on the land to be summerfallowed. Actual experience has shown that they may be controlled with comparative ease on such land. Farmers have found that by plowing this land in strips and leaving unplowed lands about twenty feet wide, the grasshoppers will gather on these unplowed areas. This is true only before the grasshoppers develop their wings. These strips of unplowed land where the grasshoppers have gathered in millions should then be treated with the poisoned bait. On these areas if the grasshoppers are exceptionally thick, the bait should be used slightly more liberally than usual. Excellent results have been obtained from scattering bait on these areas. One should remember that it is important to poison these grasshoppers on land to be summerfallowed, because they move to fields of grain as soon as there is nothing more for them to eat in their old haunts.

(3) AUTUMN CONTROL

Autumn control is the same as that of early spring. Plow the eggs under to a depth of six inches, turning the furrow slice upside down. If the furrow slice is turned up on its edge, some of the eggs will be almost at the surface of the ground and will be sure to produce grasshoppers. Use a skimmer on the plow. This attachment throws the upper inside part of the furrow slice with all its eggs in the bottom of the furrow.

NOTES ON THE POISONS USED IN THE BAITS

Some form of arsenic is used as a poison in grasshopper baits. The cheapest effective and convenient form is the one to select. Experience has shown that white arsenic is cheap, and that it gives excellent satisfaction in these baits. Its main desirable characteristics are that it is much cheaper than paris green, and that it does not fly around in the air in the mixing stations as does paris green, to the inconvenience of the men doing the mixing. Paris green is much too expensive to use in poisoned baits, except where white arsenic is not available. Paris green should then be used in the emergency until a supply of the cheaper poison can be obtained. In Colorado a cheap soluble form of arsenic, known as sodium arsenite, has been used successfully. This is also available on the Canadian wholesale market at present.

NATURAL CONTROL

Natural control operates over a period of several years. When young grasshoppers are emerging artificial methods of control should be put into operation immediately. Over a period of years, however, a number of natural enemies of grasshoppers have appeared in certain localities and have assisted the farmer in keeping the grasshopper under control. Of the birds, Franklin's Gull, which breeds in great numbers around some of our small Manitoba lakes, and which appears on the cultivated land in flocks of thousands, is probably the most useful. The farmer with grasshoppers is very fortunate to have a visit from a great flock of these birds. They devour countless numbers of grasshoppers and at times clean up badly infested fields. Turkeys are fond of grasshoppers and will range far from the farm buildings in search of this favorite food.

Franklin's Gull Aiding this Farmer in Controlling Grasshoppers.

Hens will also eat grasshoppers but will not eat so many of them as will turkeys. Our grouse, no doubt, assist a great deal in keeping down insect outbreaks of all kinds, especially grasshoppers. The common English Sparrow has been seen with a grasshopper in its bill.

Among the insect enemies of grasshoppers the bee-fly is important. These insects are enemies of the eggs. Their young are commonly found in the egg pods in the spring. The red mite also attacks the egg clusters as well as the adult grasshoppers. The bodies and wings of the adult grasshoppers sometimes harbor a score or more of these parasites. They do no serious harm to the adults, however, except probably to make them uncomfortable. Sometimes the wings of old grasshoppers are badly frayed due to repeated attempts to rid themselves of these tenacious red mites.

In one limited area in Manitoba a fungous disease killed a very large percentage of the grasshoppers one season. The bodies of grasshoppers could be found hanging to the weeds and stems of the grain long after they had died.

SPECIAL INSTRUCTIONS TO MEN IN CHARGE AT MIXING STATIONS

1. The poisons used in the baits are deadly and should be used with extreme care. Care should be taken to prevent the fine dust-like particles of the poison from flying about the mixing station. Paris green is worse than white arsenic in this respect. A respirator worn over the nose will prevent the fine particles from being inhaled. Care should be taken to keep the hands free from cuts and open wounds.

2. All farmers who come to the station for mixed baits should be warned of the extremely poisonous nature of the material and that bags of bait should not be left where animals can get at them. The salt in the bait makes it attractive to animals where they can get at it in bulk. When it is thinly scattered on the ground there is no danger of animals getting it in harmful amounts.

3. Measure or weigh out accurate amounts of all the ingredients. Much material can be wasted by carelessness in this matter.

4. Remember that thorough mixing is absolutely essential for successful control. Every particle of the carrier should be covered with the poison. Only those pieces of the bait with poison on them have any killing value.

One of the men who had charge of a mixing station wearing a respirator to keep from inhaling the particles of poison.

5. Explain to each farmer when and how to scatter the bait. The method of doing this is explained elsewhere in this bulletin.

6. Emphasize the fact that baits should be kept until suitable weather conditions prevail for successful poisoning. Much money can be saved by putting the baits out only during favorable weather conditions. Baits will not deteriorate if kept in a bag for a few days.

"DON'TS"

1. Under Manitoba conditions of farming we do not advise the use of the hopper-dozer. This is a home-made machine which is dragged over the infested field. It is so constructed that by the use of coal oil and water the grasshoppers are caught and killed by coming in contact with the oil. The poisoned baits produce many times better results with only a fraction of the labor.

2. The hopper catcher is a machine so constructed that it will catch the grasshoppers alive. This is also a machine not at all adapted to our conditions.

3. Attempts to burn the grasshoppers with special burning machines when the grasshoppers were very numerous in any one place also proved unsuccessful. All devices constructed with this principle in view have been discarded in favor of the poisoned bait.

4. In areas where the young grasshoppers were swarming over the ground, an attempt was made to spray them with oil. This proved very slow and was considered a failure.

LEGISLATION IN MANITOBA RELATING TO INSECTS

An Act to Amend the Municipal Act, 1920 :—

600A. The council of a municipality may, by resolution supported by two-thirds of its members, institute measures for the destruction and control of grasshoppers or other insect pests injurious to crops, and may vote out of the general revenue of the municipality such sum or sums as may be required for the purpose.

IDENTIFICATION OF INJURIOUS INSECTS

All unknown insects which are injurious to field crops, vegetables, shade and fruit trees, animals and to the household in any way, should be sent to Manitoba Agricultural College, Winnipeg, for identification. The postage is one cent per ounce on packages of this sort. Place the specimens in a cardboard box along with some of their food if possible and wrap securely. Be certain to place your name and address on the package. We shall identify the specimens and suggest practical methods of control.

Manitoba Farmers' Library

List of Bulletins of this Series Available for Distribution at time of Publication of this Bulletin

Extension Bulletin No. 11—Management of the Brood Mare and Foal.
Extension Bulletin No. 13—Common Diseases and Disorders of the Foal.
Extension Bulletin No. 15—Poultry Houses for Farm and Town.
Extension Bulletin No. 32—Poultry Diseases.
Extension Bulletin No. 36—Agricultural Society Activities.
Extension Bulletin No. 37—Farm Buttermaking.
Extension Bulletin No. 38—Practical Cookery.
Extension Bulletin No. 40—Home Dressmaking.
Extension Bulletin No. 42—The Cream Separator on the Farm.
Extension Bulletin No. 46—Lessons in Millinery.
Extension Bulletin No. 47—Beekeeping in Manitoba.
Extension Bulletin No. 48—Common Breeds of Poultry.
Extension Bulletin No. 49—Hand Selection and Harvesting of the Seed Plot.
Extension Bulletin No. 51—Annual Pasture and Forage Crops for Manitoba.
Extension Bulletin No. 54—Milk and Cream Testing on the Farm.
Extension Bulletin No. 56—Clothing for the Family.
Extension Bulletin No. 57—Financing the Home.
Extension Bulletin No. 59—Making Clothes Last Longer.
Extension Bulletin No. 60—Fattening, Killing, Dressing and Marketing Chickens.
Extension Bulletin No. 61—Debating Clubs.
Extension Bulletin No. 62—Silo Construction.
Extension Bulletin No. 63—Feeding, Managing and Culling Poultry.
Extension Bulletin No. 64—Laundering and Dyeing.
Extension Bulletin No. 65—The Beef Ring.
Extension Bulletin No. 66—Manitoba Potato Diseases and Their Control.
Extension Bulletin No. 67—Alfalfa and Sweet Clover Growing in Manitoba.
Extension Bulletin No. 68—Making Silage in Manitoba.
Extension Bulletin No. 69—Grasses and Clovers for Manitoba and How to Grow Them.
Extension Bulletin No. 70—The Root Crop in Manitoba.
Extension Bulletin No. 71—Cereal Diseases in Manitoba.
Extension Bulletin No. 72—Home Cheese Making.
Extension Bulletin No. 73—Weeds of Manitoba.
Extension Bulletin No. 74—Growing Small Fruits in Manitoba.
Extension Bulletin No. 75—Control of Grasshoppers.